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A high mobility two-dimensional electron gas at the $CaZrO_3/SrTiO_3$ heterointerface

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The discovery of two-dimensional electron gases (2DEGs) in $SrTiO_3$-based heterostructures provides new opportunities for nanoelectronics[1,2]. Herein, we create a new type of oxide 2DEG by the epitaxial-strain-induced polarization at an otherwise nonpolar perovskite-type interface of $CaZrO_3/SrTiO_3$.[3,4] Remarkably, this heterointerface is atomically sharp, and exhibits a high electron mobility exceeding 60,000 $cm^2V^{-1}s^{-1}$ at low temperatures. The 2DEG carrier density exhibits a critical dependence on the film thickness, in good agreement with the polarization induced 2DEG scheme.

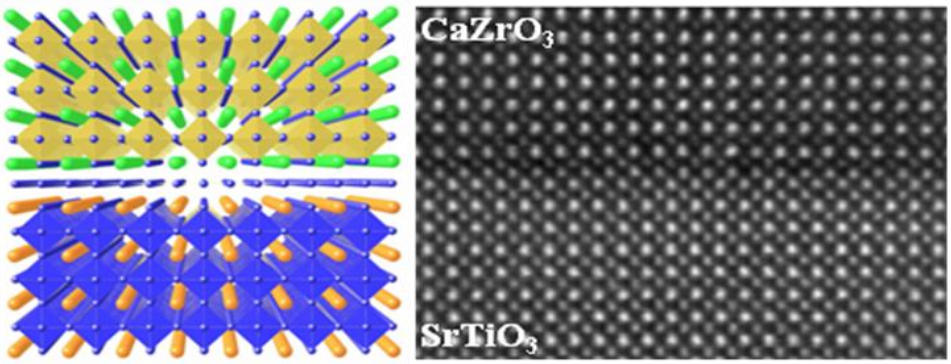

Figure 1. Atomically-flat epitaxially grown perovskite-type interface of $CaZrO_3/SrTiO_3$ determined by STEM-EELS.

Reference:

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4. S. Nazir, J. Cheng, K. Yang, Creating Two-Dimensional Electron Gas in Nonpolar/Nonpolar Oxide Interface via Polarization Discontinuity: First-Principles Analysis of $CaZrO_3/SrTiO_3$ Heterostructure. *ACS appl. Mater. Interfaces.* 8, 390 (2016).